DECLARATION OF ERIK SULDA

ERIK SULDA having personal knowledge of the facts set forth herein, except where such facts are stated to be on information and belief, states that:

1. I am a named co-inventor of Application No. 09/543,951("the '951 application"), and I have read the prior art and the examiner's rejections of the claims of the '951 application based on that prior art.

2. Since April of 1990 I have been employed by TurboCare, Inc., of Chicopee, MA, the assignee of the '951 application. My present position is that of Technical Leader, Engineering Design and Development. I have held various positions in both engineering and technical sales at TurboCare, including eight years in engineering, and four years in technical sales. My Engineering experience includes product design and development with a focus on retractable packing and retractable brush seal packing . My technical sales experience has included responsibility for the sale and customer technical support for energy efficiency products including retractable packing. I was awarded a Bachelor of Science in Mechanical Engineering (B.S.M.E.) degree from Worcester Polytechnic Institute in 1989.

3. Prior to joining TurboCare, from June 1989 to April 1990, I worked as a Field Engineer, supervising the overhaul and repair of large steam turbine/generator sets for General Electric Company, Power Generation Services Division, Schenectady, NY. I also attended and graduated from the General Electric Field Engineering Program.

4. I consider myself a person skilled with respect to turbine machinery and shaft seals for use in such machinery, the art to which the '951 application relates. I have worked with engineers in this field for just over one decade; *i.e.*, persons of ordinary skill in the art, and the opinions I express herein

would, in my opinion, typify the views of the engineer having ordinary skill in this art.

5. In this declaration I will discuss the technical differences between the claimed invention and prior art on which the Examiner has relied, and explain the benefits of the claimed Invention.

6. The invention set forth in the '951 application, as most broadly claimed in the independent claims now pending, is for a retractable shaft seal for use in a turbine in which the sealing member includes a brush seal element. The retractable segments are cut such that along any cross section perpendicular to the shaft, the ends of the segments lie along a radius. The brush is cut an angle not along the radius, having a circumferential overlap with the brush in an adjacent segment.

7. I have read the Examiner's action of August 1, 2002, and understand that these claims of the '951 application have been rejected as obvious and unpatentable over United States Patent No. 5,810,365 to Brandon ("the Brandon '365 Patent") in view of United States Patent No. 6,030,175 to Bagepalli et al. ("the Bagepalli '175 patent").

8. The concept of a retractable shaft seal in which the seal is opened by springs at low loads and dosed by the working fluid of the turbine at operating loads has been known since the United States Patent No. 4,436,311 which issued to Ronald Brandon in 1984. Variations of this retractable seal construction are disclosed in the Brandon '365 Patent which was relied upon by the examiner in this rejection.

9. In a retractable seal, as illustrated by both of the Brandon patents, the seal is movable so that there is a large clearance between the seal and the shaft at startup and at low turbine loads when the turbine shaft tends to be

unstable, and a small clearance between the seal and the shaft at normal turbine operating loads.

10. When the turbine is shut down, starting up, or operating under low loads, segments such as those described by Brandon have springs biased against the seal segments to move them radially outwardly until this outward radial motion is stopped by a stationary turbine surface such as the inside of the casing shoulders or the bottom of the casing groove. In this open position, there is a large clearance (normally about 125 mils.) between the shaft and the ends of the labyrinth teeth of the sealing member. This clearance is large enough so that the turbine shaft will not contact and damage the seal teeth during periods when the turbine shaft tends to become unstable.

11. Steam pressure increases as load increases In a steam turbine. When a desired turbine load has been reached, pressure exerted by steam which flows into the casing groove becomes high enough to force retractable seal segments radially inwardly until they are stopped by a stationary turbine surface such as the upper casing shoulders. In this closed position, there is a small clearance between the ends of the seal teeth and the shaft (normally about 25 mils) which permits efficient operation of the seal. To be effective, a retractable seal must close automatically and reliably when the desired turbine load Is reached.

12. In both of the Brandon patents the sealing member of the seal segments is a number of teeth projecting radially toward the shaft. These teeth cooperate with raised areas (lands) on the rotating shaft to form a labyrinth seal. (See the Brandon '385 patent, Figures 3, 4 and 5.)

13. The only prior art device or publication of which I am aware that discloses or incorporates a brush seal element as a part of the seal member of a retractable seal is U.S. Patent No. 6,318,728 to Addis.

14. The Bagepalli '175 patent describes what they refer to as a "hybrid" seal. The hybrid seal is a combination of labyrinth seal teeth and a brush seal. As described in the background section of the Bagepalli '175 patent, the bristles of the brush seal are typically canted at a 45□ angle with respect to the radius line, whereas the labyrinth seal teeth are cut along the radius line. Bagepalli discloses that cutting the labyrinth seal teeth at a 45□ angle would create a safety hazard to persons installing or replacing the seal, whereas trimming the ends of the brushes would leave a gap in the brush seal.

15. The Bagepalli structure is described as having first and second labyrinth seal segments with seal teeth. A "mounting block" is connected to both the first and the second labyrinth seal segments, is disposed radially outward from the two segments, and because the two segments 26 and 28 do not abut each other the block forms the bottom of a channel between the segments. The mounting block is also circumferentially offset from the two labyrinth segments so that it hangs over one end of the segments and is recessed at the opposite end. The brush seal segment is secured in channel under the mounting block so that the ends of the bristles do not extend past the ends of the labyrinth segments, as shown in Fig. 4 of the Bagepalli '175 patent. Such a structure allows the bristles of the brush seal segment to be canted at 45□ from the radius and avoids having to cut the ends of the labyrinth seal segments in a manner that would leave sharp teeth.

16. The arrangement of the Bagepalli '175 assembly would not accommodate a retractable packing segment with a brush seal as proposed in the '951 application. With reference to Figures 2 and 3 of the '175 patent, the hybrid seal disclosed in that patent has an overlap in the direction of the axial axis, between the mounting block 48 and the seal segments 26 and 28 of the mating circumferential portions. This overlapping arrangement would restrict or hinder the intended radial movement of the retractable brush seal packing segments of the '951 patent application.

17. Because of the overlapping portions between the segments of the Bagepalli '175 patent, all of the segments would have to move in unison to retract or close. The only way the Bagepalli segments could function as a practical retractable seal is if (1) the friction between each pair of abutting segments were identical with every other pair, (2) the forces tending to open (retract) the segments were always evenly balanced, and (3) the forces tending to close the segments were always evenly balanced. In reality, friction between all pairs of segments are never identical, and the opening and closing forces are never evenly distributed. Even assuming that the Bagepalli '175 patent uses the springs as disclosed in the Brandon patent cited by the examiner to provide the opening force, the spring forces are never identical as a practical matter. In addition, the steam pressure affects both the opening and closing of the segments. The segments are designed to close or to retract only during periods such as start-up and shut-down only when the steam pressure is varying. Therefore, the real life problems of different spring forces, friction, and varying steam pressure would prevent the Bagepalli '175 segments from functioning as a retractable packing.

18. Because of these real life problems, the ends of the segments in the '951 application are cut along the radius. This configuration virtually eliminates the problem of friction affecting the opening and closing of the segments and allows the segments to move independently of each other. Because of this independence, a type of independent suspension, the segments have the ability to open and close at slightly different times or rates as the steam pressure changes.

19. In my opinion, for all of the above described reasons, the invention described in the '951 application would not be obvious in view of the teachings of the Brandon patent alone or combined with the teachings of the Bagepalli patent.

20. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Erik Sulda

29-Oct-02
Dated